REMARKS

Claims 12-19 and 59-90 are pending in the present application. Claims 12-19 and 59-90 have been rejected under § 112 as failing to comply with the enablement requirement. Claims 12-19, 76, 79, 82, and 86 have been rejected under § 112 as being indefinite. Claims 12-19 and 59-90 have been rejected under § 103 as being unpatentable over applicants' admitted prior art.

Dependent claims 63 and 72 have been amended to make the claims more clear. Claims 63 and 72 were not made in response to any rejections.

New dependent claims 91-92 have been added.

Section 112 Rejections - Enablement

The Office Action alleges that the claims contain subject matter which was not described in the specification in such a way as to enable one skilled in the art to make and/or use the invention. Specifically, the Office Action states that claim 12 recites that the computer model is used to determine one or more optimal locations in the combustion system for the injection of particles, and alleges that there is nothing in the specification which would teach one how the model is used to make such a determination, other than to state that various computer programs are known. Applicants disagree.

To help make the following arguments clear, a brief description of the apparatus and method described in the specification follows. The description relates to the field of combustion systems, including techniques for capturing gas phase pollutants, such as sulfur trioxide. (Spec., p. 2, para. 2). A typical combustion system includes a furnace or combustion chamber for burning fuel and an air preheater for heating an air stream before being injected into the furnace. (Spec., p.p. 2-3, para. 3). Fuel impurities include S, N, Hg, Na, Al, Si, P, K, Ca, Ti, Fe, V, Ni, As, Cl, and others. Combustion systems burn the fuel and extract energy, resulting in gas cooling.

System design and operating conditions impact the form and fate of impurities. The present invention provides methods and systems for improving the capture of impurities (pollutants).

While any desired type of computer model may be used with the present invention, the Specification describes examples. Other computer models may also be used within the spirit and scope of the invention. With respect to claim 12, for example, the claim recites "creating a computer model of the combustion system for modeling various parameters in the combustion system..." Any desired computer model may be used that models various parameters in a combustion system. The Specification merely provides examples of such a model. The same argument applies to the other claims.

In the examples given in the Specification, several computer programs are used to help create a computer model of a combustion system. The computational fluid dynamics (CFD)–Fluent program can be used to calculate gas velocity and temperature in a combustion system. Gas composition is based on fuel composition. (Spec., p.13, para. 27). The ATRAN and general dynamics equation (GDE) programs are combined to predict certain specifications. The ATRAN particle-size and composition distribution (PSCD) of the ash produced upon combustion is combined with the GDE component that calculates the condensation (homogeneous and heterogeneous) of gas-phase species as a function of gas temperature. (Spec., para. 30, 33, FIG. 5). Injection of very fine sorbents provides sites for heterogeneous condensation. The ATRAN–GDE model provides input as to the sorbent injection rates, fuel impurity impacts, and operating conditions of devices such as the air preheater (APH). In addition, the model provides the data showing the effect of operating conditions on the extent of condensation. (Spec., p.p. 18-19, para. 39).

Gas temperature changes and the use of gas cooling can be used to increase condensation of gas-phase species such as SO_3. (Spec., p.p. 14-16, para. 31-33). This can be accomplished by modifying the operation of the APH and operating under conditions that increase condensation. (Spec., p.p. 8-9, para. 20). This is typically not an acceptable operating regime because of APH fouling. Using ATRAN–GDE, sorbent injection conditions for acceptable nontypical operating conditions can be determined. Increased heterogeneous condensation is accomplished by the combined use of the Atran–GDE model to predict the PSCD of the ash and the condensation of the volatilized species on the surfaces of sorbent at various injection rates and ash particle sizes. (Spec., p.p. 14-15, para. 30-31). SO_3 and other gas phase pollutant emission reductions are accomplished through the combined use of the ATRAN–GDE model, sorbent injection, and gas-cooling device operation. Many other details of an exemplary computer model can be found in the Specification.

In response to the Examiner's specific concern that the Specification does not "teach one how the model is 'used' to make such a determination [optimal locations for the injection of particles]…," Applicants disagree and refer to the Specification to illustrate such a teaching. The specification recites,

> "The computer model described above can be used to find optimal locations for the injection of fine particles into a combustion system for the capture of gas phase pollutants. The model can also be used to determine optimal size and amounts of particles to be injected. Following is one specific example showing the results obtained with the present invention. Other models that employ the same calculations could be used." (Spec., p. 16, para. 35).

The Specification then recites examples of how these determinations can be accomplished,

> "As mentioned above, the model is used by the present invention to determine injection locations, as well as the size and amount of particles to be injected. These determinations can be made in any desired manner. For example, to determine one or more optimal injection locations, a temperature profile generated from the model can reveal locations where pollutant condensation

> starts to occur. It is usually desirable to use a location such that pollution condensation occurs primarily on the injected particles. Typically, the optimal locations will be in the proximity of the air preheaters, but the optimal locations will vary, depending on various factors in the combustion system and the pollutant of interest. In another example, to determine the optimum particle concentration, size, and amount, iterations can be run using the model to determine when pollutant concentration is reduced to an acceptable level. In another example, with or without using a model, pollutant removal can be measured experimentally using various locations and/or various particle concentrations, sizes and amounts. When the pollutant level is measured to be an acceptable level, the corresponding injection location and particle concentration, size and amount can be used.." (Spec., p.p. 18-19, para. 39).

The parameters mentioned in the paragraph above (e.g., temperature profile, optimal particle size amount and concentration, etc.). can be generated by the computer model. In other words, information generated by the computer model is used, along with other factors (e.g., the pollutant of interest, an acceptable pollutant level, etc.) to make the desired determinations.

<u>Section 112 Rejections - Definiteness</u>

The Office Action alleges that terms such as "desired level" and "determined" render the claims vague and indefinite. Applicants assert that these are common patent claim terms, and are definite, as used in the claims of the present application. First, with respect to "desired level," claim 12 recites "... to reduce the pollutants to a desired level." Applicants assert that the use of "desired level" is clear and definite. A person skilled in the art will realize that the desired level of a pollutant would be the concentration that satisfies one or more criteria such as a reduction to a level which complies with regulatory standards, a reduction to a level which satisfies ascetic concerns, such as the flue gas opacity, and/or a reduction to a level at which the pollutant will not corrode or damage downstream plant equipment exposed to the flue gas, etc..

Second, with respect to the term "determined," Applicants also assert that the use of this term is clear and definite. The term "determined" is used in the claims in its ordinary manner. For example, claim 12 recites "using the computer model to determine one or more optimal

locations..." and "using the computer model to determine an optimal size and amount ...", which provides an anticedent basis for "injecting the determined amount and size of particles into the combustion system at one or more of the determined locations..."

The Office Action states that claims 76 and 86 are indefinite for reciting "include, but not limited to." Claims 76 and 86 have been reworded to overcome this rejection.

The Office Action states that in claim 79, "small enough," "large enough," and "sufficient" are indefinite. Claim 79 has been reworded to overcome this rejection.

The Office Action states that claim 82 uses improper Markush terminology. Claim 82 has been reworded to overcome this rejection.

Prior Art Rejections

Claims 12-19 and 59-90 have been rejected under § 103 as being unpatentable over applicants' admitted prior art. The Office Action alleges that Applicants admit (in para. 24-27) that the computer programs ATRAN, Chemkin, and FLUENT are known to model combustion systems. Applicant disagrees that an admission was made that these programs are "known to model combustion systems." For example, in para. 24, the Specification states that ATRAN (as used by the present invention) predicts PSCD of ash produced during the combustion of coal. (Spec., p.p. 11-12, para. 24). In para. 26, the Specification states that Chemkin is chemical reaction kinetics computer code that (as used by the present invention) provides a means to determine the rates of reaction of various components in flue gas systems and to determine the rates of SO3 formation upstream of the air preheater. (Spec., p. 12, para. 26). In para. 27, the Specification states that FLUENT is a computational fluid dynamics code that (as used by the present invention) is able to model the flow of gas-phase and particulate-phase materials and provide the velocity and temperature distribution through heat exchange devices such as air

preheaters. (Spec., p. 13, para. 27). Nowhere in these paragraphs do the Applicants state these programs model combustion systems. In contrast, the Specification describes how these programs are used together as tools to create a model of a combustion system.

The three computer programs (ATRAN, Chemkin, and FLUENT) cited in the Office Action as prior art do not provide any motivation or reason why they should be combined. Further, Applicants find no evidence that these programs have ever been used together to model a combustion system. Also, even if these three computer programs were combined, the combination does not anticipate the elements in the claims. For example, referring to claim 12, nothing in ATRAN, Chemkin, and FLUENT (by themselves or in combination) teaches or suggests how to determine factors such as optimal injection locations, optimal particle sizes, optimal particle amounts. In addition, these three programs teach nothing (to Applicant's knowledge) about injecting particles into a combustion system to capture gas phase pollutants.

For at least these reasons, applicant asserts that all of the claims are allowable over the prior art.

Conclusion

It is respectfully submitted that all claims are patentable over the prior art. It is further more respectfully submitted that all other matters have been addressed and remedied and that the application is in form for allowance. Should there remain unresolved issues that require adverse action, it is respectfully requested that the Examiner telephone Bruce A. Johnson, Applicants' Attorney at 512-301-9900 so that such issues may be resolved as expeditiously as possible. Charge any additional fee(s) or underpayments of fee(s) under 37 CFR 1.16 and 1.17 to deposit

account number 50-3864 (Johnson & Associates).

Respectfully Submitted,

9/18/07
Date

Bruce A. Johnson
Reg. No. 37361
Attorney for Applicant(s)

Customer Number 30163
Bruce A. Johnson
Johnson & Associates
PO Box 90698
Austin, TX 78709-0698
Tel. 512-301-9900
Fax 512-301-9915